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Demersal Fishes and Invertebrates Trawled in the Northeastern Chukchi and Western Beaufort Seas, 1976-77

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Kathryn J. Frost and Lloyd F. Lowry

February 1983

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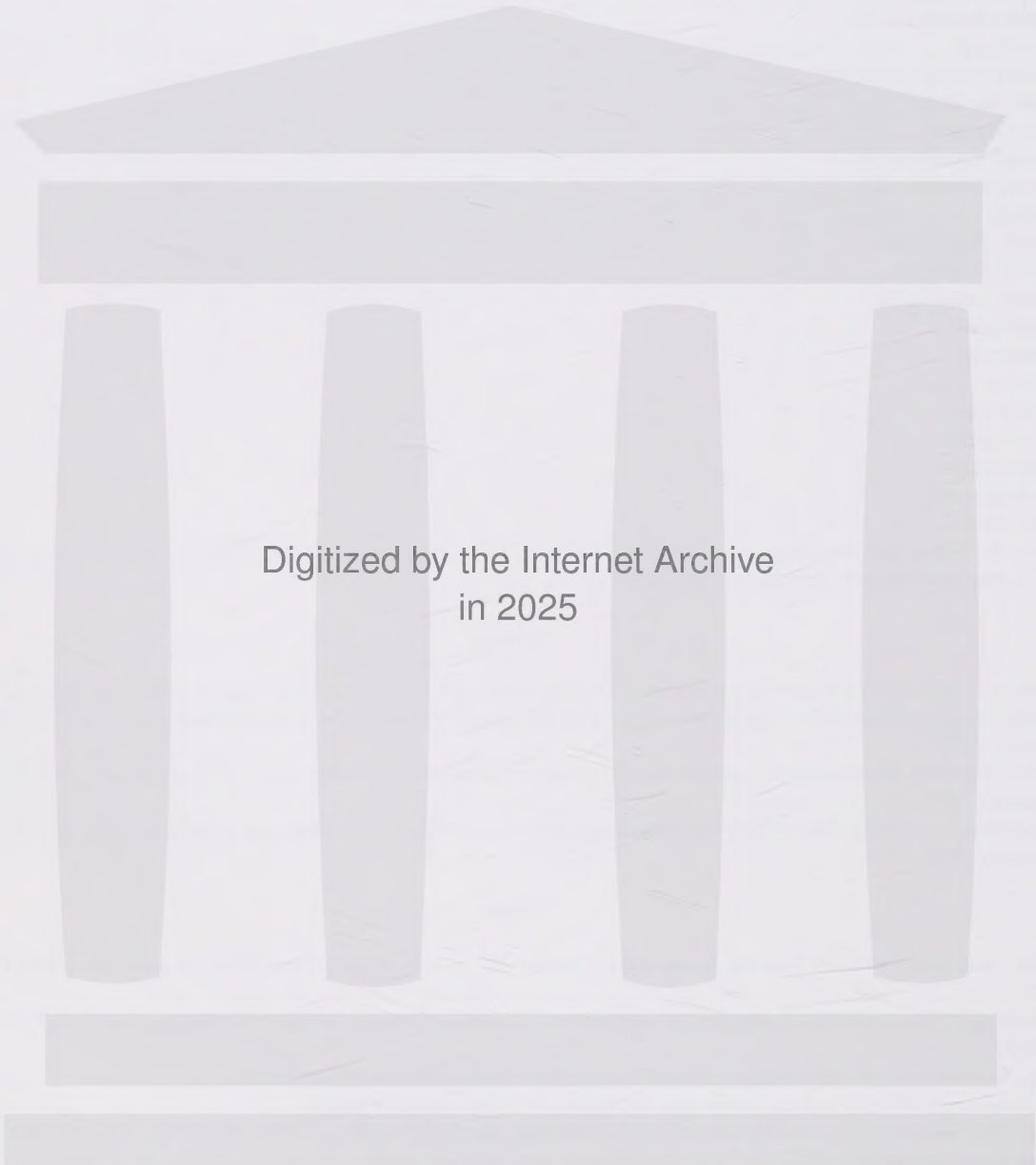

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Demersal Fishes and Invertebrates Trawled in the Northeastern Chukchi and Western Beaufort Seas, 1976–77

KATHRYN J. FROST and LLOYD F. LOWRY[1]

ABSTRACT

Thirty-five successful otter trawl tows were conducted in the northeastern Chukchi and western Beaufort Seas in August–September of 1976 and 1977. Nineteen species or species groups of fishes and 238 invertebrate taxa were identified. Three of the fishes (*Boreogadus saida*, *Lycodes polaris*, and *Icelus bicornis*) accounted for 65% of all fishes caught. Information on size, reproductive condition, and food habits is presented for those three as well as for *Artediellus scaber*, *Aspidophoroides olriki*, *Liparis* spp., *Eumicrotremus derjugini*, *Gymnelis viridis*, and *Icelus spatula*. The first Beaufort Sea records are reported for three species: *Arctogadus glacialis*, *Lycodes raridens*, and *Eumesogrammus praecisus*. Of the invertebrate taxa, echinoderms (mainly brittle stars and crinoids) were the most abundant, and in most cases comprised more than 75% of the total trawl biomass. West of long. 154°W, brittle stars, *Ophiura sarsi*, were predominant whereas east of long. 150°W, the invertebrate community was characterized by crinoids (*Heliometra glacialis*) and small scallops (*Delectopecten groenlandicus*). Information on size, reproductive condition, and depth distribution is presented for brachyuran crabs and shrimps and the occurrence of other major invertebrate groups is summarized. A complete list of species and stations at which each was caught is included.

INTRODUCTION

Since 1975, as a prelude to offshore petroleum exploration, biological research in the Alaskan sector of the Beaufort Sea has been intensified under the auspices of the Alaskan Outer Continental Shelf Environmental Assessment Program (OCSEAP). In the course of these studies, it became evident that information on the distribution, abundance, and life history characteristics of offshore fishes and epibenthic invertebrates was almost totally lacking. Since certain of those organisms were known to be important prey of marine mammals, seabirds, and other fishes, a trawl survey was conducted in the northeastern Chukchi and western Beaufort Seas to begin to obtain such information. Since trawls were made in conjunction with an investigation of the feeding and trophic relationships of ringed seals, *Phoca hispida*, and bearded seals, *Erignathus barbatus*, more detailed attention was paid to species or groups which were of potential importance to these seals.

Walters (1955) summarized information available prior to 1955 on the marine fish fauna of arctic Alaska and included a discussion of taxonomy and zoogeography. Alverson and Wilimovsky (1966) and Quast (1972) conducted trawl surveys in the Chukchi Sea south of Icy Cape. Quast and Hall (1972) published a list of fishes of Alaska and included some new records from Icy Cape and Point Barrow. Pfeifer (1977) compiled an extensive bibliography of fishes of the Beaufort Sea but most of the literature cited therein deals with freshwater, anadromous, and nearshore species. References to offshore demersal fishes of the northeastern Chukchi and western Beaufort Seas are restricted to distributional records (primarily from near Point Barrow), taxonomic studies, or anecdotal accounts. Life history information for widely distributed species can be found in studies from coastal arctic Alaska (e.g., Bendock 1979) and Soviet and Canadian waters (Andriyashev 1954; McAllister 1962).

Information on epifaunal invertebrates is restricted largely to the Barrow area and nearshore waters. Most reports are of strictly taxonomic nature. The report of MacGinitie (1955) provides the most complete information available on the distribution, abundance, and life history of invertebrates near Point Barrow. MacGinitie (1959) described the distribution and taxonomy of gastropods in that area and Hulsemann (1962) gave a similar treatment of bivalve molluscs. Shoemaker (1955) reported on distribution of amphipods and Menzies and Mohr (1962) examined collections of isopods and tanaids. Hedgpeth (1963) reported on pycnogonids of arctic America and Hulsemann and Soule (1962) listed some bryozoans found along the arctic coast of Alaska. Squires (1969) described the distribution and life history of decapod crustaceans in the Canadian Arctic. Recent benthic sampling by Carey (1977) in the western Beaufort Sea has dealt mainly with distribution and abundance of infaunal organisms. Also included in that work is a valuable compilation of distributional information and an exhaustive literature survey.

METHODS

In 1976 two tows were made in the western Beaufort Sea between long. 152° and 153°W and lat. 71° and 72°N in water 40 m and 123 m deep. In 1977 tows were made in the northeastern Chukchi and western Beaufort Seas between long. 164° and 141°W and lat. 70° and 72°N in waters 40 to 400 m deep. Many were conducted near the southern edge of pack ice. We sampled with semiballoon otter trawls of two sizes. Headropes were 4.9 and 5.8 m (16 and 19 ft). Nets were constructed of 3.2 cm (1¼ in) stretch mesh webbing with 0.6 cm (¼ in) stretch mesh liners in the cod ends. Tows were 5–10 min bottom time at a speed of 5–8 km/h.

Organisms were sorted from debris and readily identifiable species were counted and weighed. The occurrence of rocks, pebbles, or mud in the net was noted. All organisms were preserved in 10% Formalin. Stomachs of fishes were injected with 10% Formalin.

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In the laboratory, fishes were measured to the nearest 0.1 cm fork length (FL), or total length (TL) if fork length was not appropriate, and weighed to the nearest 0.1 g. Otoliths were polished and cleared in xylene; the annuli were counted to estimate age. Stomach contents of each fish were classfied by major taxonomic group and the volumetric abundance of each group was assigned a ranked value. Invertebrates from each trawl were identified to the lowest possible taxonomic level. Members of each species or taxon were weighed and enumerated. Carapace lengths (CL) of decapod crustaceans were measured to the nearest 0.1 cm. The numbers of ovigerous crabs and shrimps in each trawl were noted.

RESULTS AND DISCUSSION

Thirty-three successful tows were conducted from 2 August to 3 September 1977; two (indicated by A and B, Fig. 1) were made on 30 and 31 August 1976. Ten were west of Point Barrow, 10 between Barrow and Prudhoe Bay, and 15 between Prudhoe Bay and the U.S.-Canada demarcation line (long. 141°W). Depth distribution of tows was as follows: 14 at 40–50 m, 11 at 51–100 m, 9 at 101–150 m, and 1 at 400 m (Table 1).

Nineteen species or species groups of fishes and 238 species or species groups of invertebrates were identified (Appendix A). The natural history information presented in this report is only from collections made in 1977; material from the 1976 tows was identified and enumerated but not further worked up. Representative specimens of invertebrates are catalogued and located at the University of Alaska Marine Museum. Those fishes representing range extensions are held in the Ichthyology Collection, National Museum of Natural Sciences, National Museums of Canada, Ottawa, Canada (NMC).

Fishes

We caught 133 fishes belonging to 14 species[2] in trawls made in 1976. In the more extensive trawl series done in 1977, 512 fishes were caught belonging to 17 species (Table 2). Three species (*Boreogadus saida*, *Lycodes polaris*, and *Icelus bicornis*) accounted for 65% of all fishes caught. Eight species were represented by five or fewer specimens.

Previous records of fishes of northern Alaska have been compiled by Walters (1955), Quast and Hall (1972), and Carey (1978). A list of all marine species reported in those compilations to occur in the northeastern Chukchi and Beaufort Seas is given in Table 3 along with the species recorded in this report and by McAllister (1962) for the eastern Beaufort Sea. Of the 41 species listed, 5 (*Limanda aspera*, *Lumpenus maculatus*, *Myoxocephalus scorpius*, *Nautichthys pribilovius*, and *Podothecus acipenserinus*) are primarily Bering Sea forms which only rarely occur as far north as Point Barrow. The remaining 36 species appear to be fairly widely distributed and can be considered characteristic of the fauna of the

[2]In the following presentation of results and discussion, all snailfishes are considered as *Liparis* spp. and counted as one form. The number of species inhabiting the northeastern Chukchi and Beaufort Seas cannot at present be determined due to taxonomic confusion in the group.

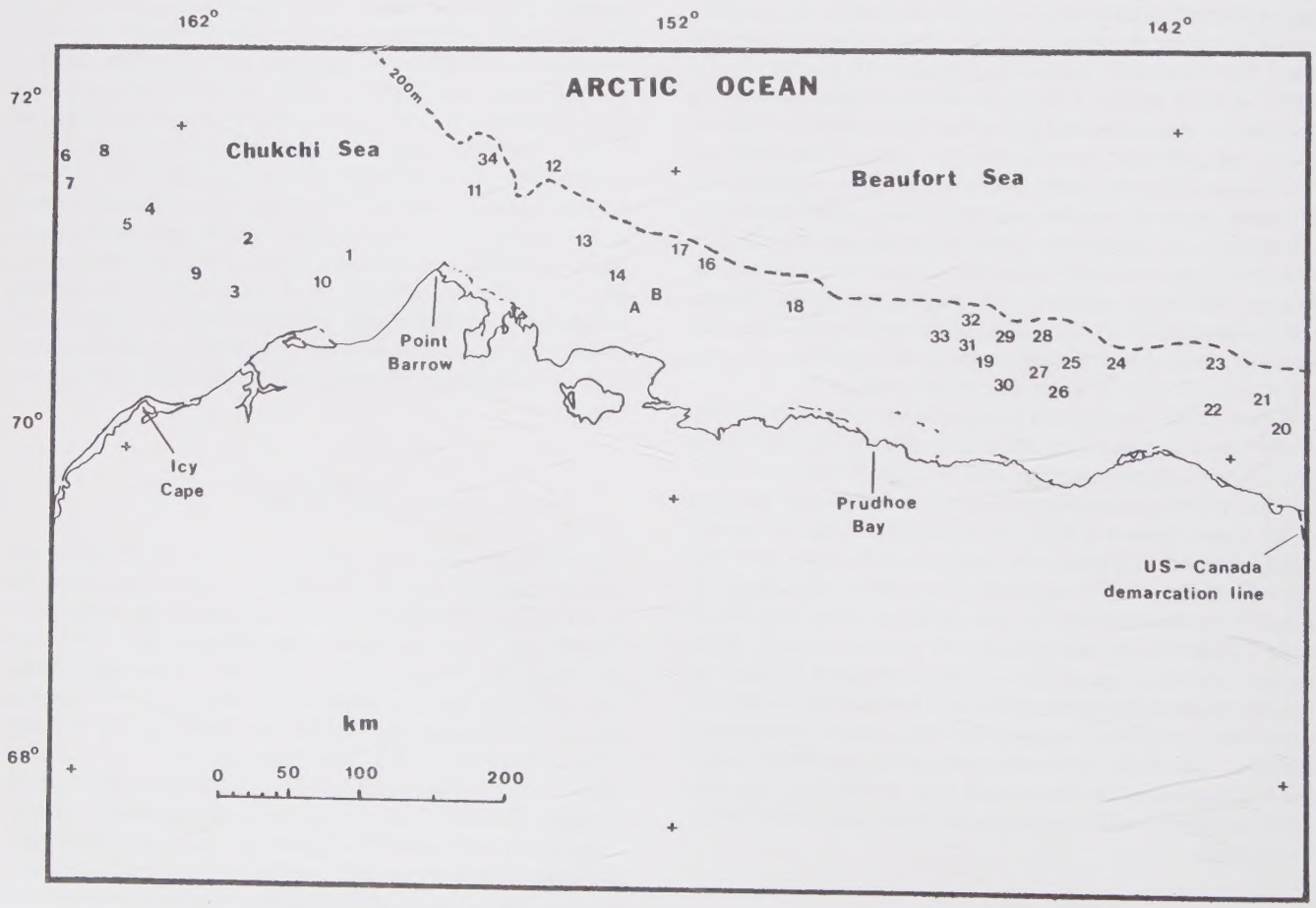

Figure 1.—Locations of otter trawl stations in the northeastern Chukchi and western Beaufort Seas, August-September 1976 and 1977.

Table 1.—Station locations of 35 tows from the northeastern Chukchi and western Beaufort Seas during August–September 1976 and 1977.

Tow no.	Date	Depth (m)	Latitude (N)	Longitude (W)	Comments
A	30 Aug. 1976	123	71°19′	152°34′	Pebbles
B	31 Aug. 1976	40	71°13.5′	152°47.9′	Rocks, pebbles, shells
1	2 Aug. 1977	64	71°27′	158°02′	Mud, gravel
2	2 Aug. 1977	45	71°19′	160°01′	Mud
3	2 Aug. 1977	62	71°05′	160°08′	Rocks
4	3 Aug. 1977	43	71°26′	162°01′	Mud
5	3 Aug. 1977	40	71°20′	162°30′	
6	3 Aug. 1977	48	71°35′	163°58′	
7	4 Aug. 1977	44	71°28′	163°47′	Mud
8	4 Aug. 1977	44	71°44′	162°59′	Mud
9	5 Aug. 1977	50	71°07′	161°00′	
10	6 Aug. 1977	102	71°12′	158°35′	Gravel, rocks
11	7 Aug. 1977	100–120	71°45′	155°43′	Mud
12	9 Aug. 1977	400	71°55.5′	154°16′	Mud
13	10 Aug. 1977	51–58	71°35.4′	153°41.0′	Mud
14	11 Aug. 1977	50	71°16′	153°01.9′	Rocks
16	12 Aug. 1977	50	71°13.1′	151°23′	Rocks
17	12 Aug. 1977	50	71°16.5′	151°33′	Rocks
18	16 Aug. 1977	40	71°06′	149°42′	Rocks, mud
19	18 Aug. 1977	55	70°46′	146°30′	No mud
20	26 Aug. 1977	56	70°09′	141°17′	Rocks
21	27 Aug. 1977	80	70°17′	141°39′	Rocks
22	27 Aug. 1977	50	70°18.4′	142°37′	Rocks
23	27 Aug. 1977	75	70°30.5′	142°21′	Gravel, rocks
24	27 Aug. 1977	105	70°36.5′	143°55′	
25	28 Aug. 1977	110	70°43.8′	145°02′	Rocks
26	29 Aug. 1977	50	70°35.5′	145°13′	Rocks
27	29 Aug. 1977	54	70°40′	145°32′	
28	29 Aug. 1977	110	70°50′	145°31′	
29	30 Aug. 1977	130	70°50′	146°00′	
30	30 Aug. 1977	54	70°38′	146°04′	Rocks
31	30 Aug. 1977	56	70°47′	146°33′	
32	30 Aug. 1977	90–110	70°56.5′	146°32′	
33	31 Aug. 1977	70	70°53′	147°01′	Rocks
34	3 Sept. 1977	150	71°59′	155°42′	

northeastern Chukchi and Beaufort Seas. For three of those species (*Arctogadus glacialis* (NMC82-0027), *Lycodes raridens* (NMC78-0296), and *Eumesogrammus praecisus* (NMC82-0026)), the first Beaufort Sea records are from our trawls. Our records of *Lycodes rossi* (NMC78-0289) fill a major gap in the known distribution of the species which had been previously reported only from the Kara Sea, Spitsbergen, and Herschel Island, Canada.

Many of the species listed by other authors were not encountered in our tows since pelagic species such as salmonids and osmerids were not adequately sampled by our otter trawl and some species such as *Myoxocephalus quadricornis* and *Liopsetta glacialis* are restricted in distribution to coastal, brackish waters (Walters 1955; Alverson and Wilimovsky 1966).

All of the primarily marine species reported from western arctic Canada by McAllister (1962) have been recorded from arctic waters of the northeastern Chukchi or western Beaufort Seas (Table 3). McAllister suggested that this low arctic fauna, which he termed the Innuit fauna, extends continuously from the Boothia Peninsula region of the central Canadian Arctic westward through the Beaufort, Chukchi, East Siberian, Laptev, Kara, and Barents Seas. Faunal connections with the eastern Canadian Arctic and North Atlantic are restricted, probably because of differences in water temperature, salinity, and ice cover.

Alverson and Wilimovsky (1966) and Quast (1972) reported the results of trawl surveys in the Chukchi Sea south and west of Icy Cape in which they found approximately 43 species of marine fishes. Fourteen of those, including 3 species of Pleuronectidae and 6 species of Cottidae, have not been reported from the northeastern Chukchi and Beaufort Seas (Table 3). Those species are all primarily North Pacific/Bering Sea forms which apparently reach the northern limit of their distribution in the central Chukchi Sea near Icy Cape. As mentioned previously, an additional five species reach only to the vicinity of Point Barrow.

Table 2.—Fishes caught in waters 40 m and deeper in the northeastern Chukchi and western Beaufort Seas during August–September 1976 and 1977, ranked in order of decreasing numerical abundance in tows.

Latin name	Common name	No. of individuals		No. of stations			Depth range (m)
				Chukchi	Beaufort		
		1976	1977	1976	1976	1977	
Boreogadus saida	Arctic cod	33	194	10	2	18	40–400
Lycodes polaris	Canadian eelpout	40	81	3	2	11	40–150
Icelus bicornis	Twohorn sculpin		74			13	50–130
Artediellus scaber	Hamecon	6	30	5	1	5	40–70
Aspidophoroides olriki	Arctic alligatorfish	17	19	1	2	3	40–400
Liparis sp.	Snailfish	5	29	3	2	15	40–400
Eumicrotremus derjugini	Leatherfin lumpsucker		29			11	50–110
Gymnelis viridis	Fish doctor	4	23	4	1	7	40–130
Icelus spatula	Spatulate sculpin	6	14	1	1	2	56–123
Lumpenus fabricii	Slender eelblenny	11			2		40–123
Lycodes raridens	Eelpout	3	7	1	1	1	64–123
Gymnocanthus tricuspis	Arctic staghorn sculpin	3	2		1	2	40–58
Eumesogrammus praecisus	Fourline snakeblenny	1	3	2	1	1	40–64
Triglops pingeli	Ribbed sculpin	1	2	0	1	2	40–110
Lycodes mucosus	Saddled eelpout	1	2		1	2	40–105
Lycodes rossi	Threespot eelpout	2			1		123
Arctogadus glacialis	Polar cod		1			1	150
Lumpenus medius	Stout eelbenny		1			1	40
Lumpenus maculatus	Daubed shanny		1	1			44

Table 3.—Fishes recorded from the northeastern Chukchi and Beaufort Seas in this and previous studies.

Species	Sources				
	Walters 1955	Quast & Hall 1972	Carey 1978	This report	McAllister 1962
Petromyzonidae					
Lampetra japonica	x				x
Clupeidae					
Clupea harengus	x		x		x
Salmonidae					
Salvelinus alpinus	x	x	x		x
Oncorhynchus gorbuscha	x		x		
Oncorhynchus keta	x	x	x		
Osmeridae					
Mallotus villosus	x	x	x		x
Osmerus mordax	x	x	x		x
Myctophidae					
Benthosoma glaciale	x				
Gadidae					
Arctogadus borisovi	x	x			
Arctogadus glacialis				x	
Boreogadus saida	x	x	x	x	x
Eleginus gracilis	x				x
Gadus morhua ogac	x		x		
Zoarcidae					
Gymnelis viridis	x	x		x	
Lycodes jugoricus	x				x
Lycodes mucosus		x		x	
Lycodes pallidus	x		x		x
Lycodes polaris	x	x		x	x
Lycodes raridens				x	
Lycodes rossi				x	x
Ammodytidae					
Ammodytes hexapterus	x				x
Cottidae					
Artediellus scaber		x		x	x
Artediellus uncinatus	x	x			
Gymnocanthus tricuspis	x	x		x	x
Icelus bicornis	x	x		x	x
Icelus spatula		x		x	x
Myoxocephalus quadricornis	x	x	x		x
Myoxocephalus scorpiodes		x	x		x
Myoxocephalus scorpius	x	x			
Nautichthys pribilovius		x			
Triglops pingeli	x	x		x	x
Agonidae					
Aspidophoroides olriki	x	x		x	x
Podothecus acipenserinus	x	x			
Cyclopteridae					
Eumicrotremus derjugini		x		x	
Liparis spp.	x	x	x	x	x
Stichaeidae					
Eumesogrammus praecisus				x	
Lumpenus fabricii	x		x	x	x
Lumpenus maculatus				x	
Lumpenus medius			x	x	
Pleuronectidae					
Limanda aspera	x				
Liopsetta glacialis		x	x		x
Platichthys stellatus			x		

Boreogadus saida.—Arctic cod were the most abundant and consistently present fish in our survey. They were caught in each of 20 tows west of Prudhoe Bay with an average of 9 fish caught per tow (range 1–26). However, they were caught in only 10 of 15 tows east of Prudhoe Bay with an average of only 2 fish caught per tow (range 0–11). Arctic cod were caught at all depths between 40 and 400 m and we saw no obvious correlation between abundance and depth of tow.

Individuals were 4.5–18.0 cm FL with a distinct mode at about 8.0 cm (Fig. 2). The length-weight relationship of Arctic cod is $W = 0.0018 \cdot L^{3.500}$ ($N = 118$, $r = 0.987$) (Frost and Lowry 1981). Fishes caught in waters deeper than 100 m were larger ($\bar{x} = 11.4$ cm FL) than those caught in shallower water ($\bar{x} = 8.1$ cm FL). In waters 100 m or less deep, 89% of the fishes caught were < 10.5 cm FL while in deeper water 24% of fishes caught were > 14.0 cm long. Similar size (or age) segregation has been observed in the Barents Sea (Hognestad 1968). It is probable that the length-frequency distribution for all tows combined was influenced by the depth distribution of the tows. In a series of midwater tows in the eastern Chukchi Sea, Quast (1974) found the abundance of juvenile cod was strongly correlated with depth, presumably due to a negative phototactic response.

Length at age of fishes caught by us was compared with that in other geographic areas (Table 4). It is unknown whether results for other studies were for fresh or preserved specimens. We measured preserved specimens. Arctic cod we examined had grown about 5 cm the first year and 3-4 cm in each of the following 2 yr. These rates are similar to but slightly less than those found by other investigators. There is considerable variation in size at age, which may be caused by an extended spawning period (Rass 1968) or patchy food resources with resulting variable growth.

In other geographic areas Arctic cod mature when they are 3-4 yr old or about 14–19 cm long (Gjosaeter 1973; Andriyashev 1954). We found no development of eggs in specimens smaller than 11 cm; gonads made up about 1% of body wieght. In specimens > 11.5 cm, eggs were clearly visible in the ovaries, and gonads made up 2–2.5% of the body weight. Based on size at age, Arctic cod in the Beaufort Sea probably first spawn at an age of 3 yr and a length of at least 12.5 cm. Spawning probably occurs in January and February (Klumov 1937; Svetovidov 1948; Andriyashev 1954; Hognestad 1968; Rass 1968).

In 187 Arctic cod, 157 stomachs had identifiable contents, 13 were empty, and 17 contained only unidentifiable food remains (Table 5). Copepods (mostly *Calanus hyperboreus*, *C. glacialis*, and *Euchaeta glacialis*) and the amphipod *Apherusa glacialis* were the most important prey. Mysids, the primary food of Arctic cod in nearshore waters (inside the barrier islands) of the Beaufort Sea (Bendock 1979), were a minor item in the diet of the fishes we examined from 40 m and deeper.

Lycodes polaris.—Canadian eelpout are benthic fishes common on muddy bottoms (Andriyashev 1954). They were the second most numerous species in this study and were caught at 16 stations. Forty-one of the 121 individuals were caught in tow No. 1. That trawl was on the bottom for about 1 h while the ship drifted and made mechanical repairs, and it is possible that eelpout swam into the net to feed on the contents. They occurred at 40–150 m and showed no obvious relationship between abundance and depth.

Individuals ranged from 3.8 to 24.5 cm TL with most specimens measuring < 15 cm TL (Fig. 3). A mode was present at about 8.0 cm. The length-weight relationship of Canadian eelpout is $W = 0.0054 \cdot L^{2.937}$ ($N = 76$, $r = 0.993$).

Due to the small size and opaque nature of the otoliths, this species was poorly suited for age determinations. The mode at about 8

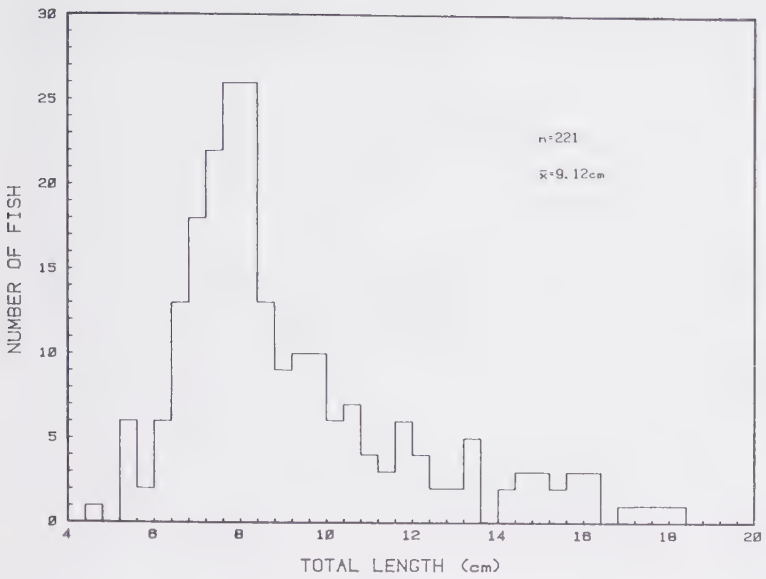

Figure 2.—Length-frequency distribution of Arctic cod caught in the northeastern Chukchi and western Beaufort Seas, August-September 1976 and 1977.

Table 4.—Mean and range of length (FL) at various ages for Arctic cod in this and other studies.

Location	This study NE Chukchi and offshore Beaufort Seas		Bendock 1979[1] Prudhoe Bay		Hognestad 1968 Barents Sea		Gjosaeter 1973 Barents Sea		Andriyashev 1954 Bering and Chukchi Seas	
Time of year	August		August		August–September		July–September		Summer?	
Age class	$\bar{x}$	range	$\bar{x}$	range	$\bar{x}$	range	$\bar{x}$	range	$\bar{x}$	range
0+			2.4		4.2	2.0–6.2			3.1	
1+	7.2	4.5–11.7	9.9		9.3	5.0–13.1	9.3		8.8	7.5–10.0
2+	11.6	9.7–14.4	13.1		14.9	8.0–22.0	13.4		15.1	14.4–15.8
3+	14.1	12.9–16.0	16.1		17.9	13.0–24.8	16.6		19.5	19.0–20.0
4+	17.1	16.1–18.0			19.8	15.5–27.0	19.1		22.5	22.0–23.0
5+					22.7	17.3–25.2	21.2			
6+					24.3	19.0–28.8	22.9			

[1]See footnote 2 in text.

Table 5.—Foods from stomachs of 157 Arctic cod collected in offshore waters of the northeastern Chukchi and western Beaufort Seas during August–September 1977.

Food item	No. of occurrences in rank 1	2	3	4	Total no. of occurrences	Frequency of occurrence (%)
Copepods	86	22	2		110	70.1
Apherusa glacialis	44	31	7		82	52.2
Other gammarid amphipods	3	9	3		15	10.2
Parathemisto sp.	2	7	4	3	16	10.2
Mysids	4	9	1		14	8.9
Euphausiids	2	2	1		5	3.2
Shrimp	1	2			3	1.9
Chaetognaths	4	3			7	4.5
Medusae	1				1	0.6

cm represented individuals 2+ yr old. The largest individual caught (24.5 cm) was probably 5+ yr old.

Ovaries of specimens <15 cm contained only small (<1 mm) eggs while those of individuals 15.5 cm and longer contained eggs of two or three size classes. Eggs of the largest size class ranged from 2.7 to 4.5 mm in diameter. The ovaries of individuals 15.5 and 18.9 cm long contained 66 and 135 "large" eggs, respectively, and the gonads made up 8.2 and 19.2% of the body weight. These measurements correspond closely with those of Andriyashev (1954). This species probably spawns in fall or early winter.

In 74 stomachs examined, 9 were empty and 12 contained only unidentifiable food remains. Of the stomachs containing identifiable food, gammarid amphipods occurred in 27, polychaete worms in 12, cumaceans and caprellids each in 4, and isopods, mysids, shrimp, brittle stars, and Arctic cod in 1 stomach each.

Icelus bicornis.—Seventy-four twohorn sculpins were caught during the 1977 survey. Only two were caught in the 18 tows made west of Prudhoe Bay. A total of 49 were caught at three stations (24, 25, 28), indicating patchy abundance. These sculpins occurred at stations ranging from 50 to 130 m. The three stations of abundance were in 105–110 m.

Twohorn sculpins ranged in length from 3.0 to 7.0 cm TL (Fig. 4). Most specimens >6 cm were females (20 of 23) and most <6 cm were males (33 of 47). Sexual dimorphism in size is not uncommon in sculpins (Andriyashev 1954). Such differences in size may be due to faster growth or differential survival of females. Nine of 11 individuals 5 yr or older were females. The length-weight relationship was similar for males and females although there was a tendency for females with well-developed ovaries to fall above the indicated line. That relationship is described by the equation $W = 0.0082 \cdot L^{3.176}$ ($N = 71$, $r = 0.955$). Length at a given age varied widely; however, the mean length of fishes increased about 2 mm/yr from the age of 3 to about 5 yr old. Eight 3+-yr-old fish averaged 5.45 cm (range 4.6–6.3, SD = 0.583), ten 4+-yr-old fish

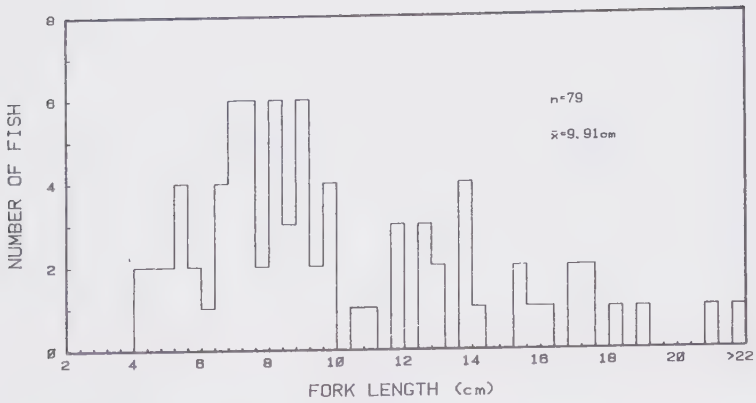

Figure 3.—Length-frequency distribution of Canadian eelpout caught in the northeastern Chukchi and western Beaufort Seas in August–September 1977.

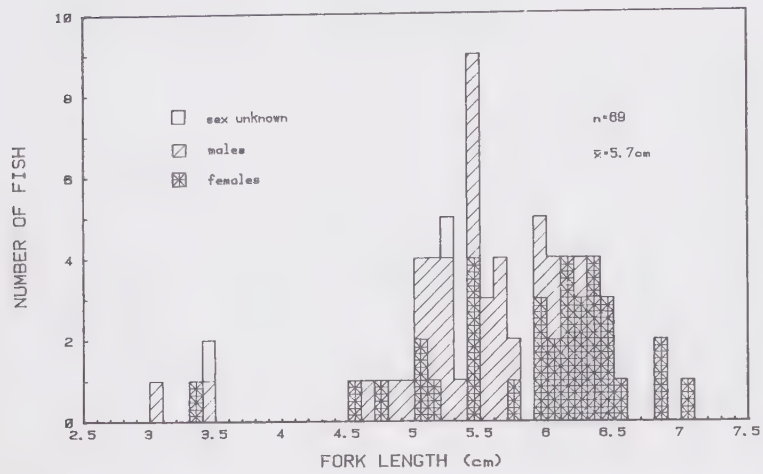

Figure 4.—Length-frequency distribution of twohorn sculpins caught in the northeastern Chukchi and western Beaufort Seas in August–September 1977.

averaged 5.65 cm (range 5.0–7.0, SD = 0.650), and six 5+-yr-old fish averaged 5.87 cm (range 5.4–6.8, SD = 0.557).

Females appeared to mature at about 4 yr of age and a size of about 6 cm. The eggs of mature females were 1.4 to 1.9 mm in diameter and ranged in number from 79 to 180. Andriyashev (1954) reported that this species spawns in August to October at which time the ovaries contain 147 to 340 eggs up to 3.1 mm in diameter.

Stomachs of 38 fishes contained identifiable remains. Gammarid amphipods occurred in 23, polychaetes in 11, mysids and isopods each in 3, euphausiids and hyperiid amphipods each in 2, and shrimp and cumaceans each in 1.

Artediellus scaber.—Thirty-six hamecon were caught at 11 stations. All stations at which they occurred were in water depths ≤70 m. Specimens ranged in size from 2.7 cm TL (0.3 g) to 7.6 cm TL (6.6 g). Females > 5.6 cm (about 3 or 4 yr old) appeared reproductively mature and had 50 to 100 eggs ranging in size from 0.6 to 1.6 mm. The oldest specimen for which age could be determined was 7 yr old. Growth from the age of 1–5 yr was about 0.8 cm/yr.

Stomachs of 24 fishes contained identifiable food. Polychaete worms and gammarid amphipods each occurred in 15 stomachs, mysids in 6, cumaceans in 2, and euphausiids, hyperiid amphipods, and isopods each in 1.

Aspidophoroides olriki.—Thirty-six Arctic alligatorfish were caught at six stations ranging from 40 to 400 m. Most were caught near and to the east of Point Barrow. Specimens ranged from 4.0 cm TL (0.3 g) to 6.7 cm TL (2.3 g). A 6.3 cm female had 260 eggs 0.8 to 1.2 mm in diameter. Six stomachs contained identifiable food. Gammarid amphipods occurred in four stomachs and polychaete worms in two.

Liparis spp.—Thirty-four snailfish were caught at 20 stations. No more than four individuals occurred in any tow. Most of the specimens could not be identified to species due to damage caused by the large quantities of mud and small rocks present in many of the tows. Three specimens were identified as *L. herschelinus* and four as *L. koefoedi*.

The liparids ranged from 3.8 cm TL (0.4 g) to 12.2 cm TL (34.5 g). Age determination was not possible because of minute size and opaque nature of the otoliths. Two specimens (8.5 and 9.7 cm TL) had numerous large (up to 2 mm) eggs which appeared nearly ripe. Of 16 stomachs containing identifiable food, gammarid amphipods occurred in 12, caprellids, hyperiid amphipods, isopods, and polychaetes each in 2, and copepods and euphausiids each in 1.

Eumicrotremus derjugini.—Twenty-nine leatherfin lumpsuckers were caught in 50–110 m: 3 west of Prudhoe Bay and 26 east of Prudhoe Bay.

Specimens ranged from 2.5 cm TL (0.7 g) to 8.5 cm TL (35.8 g). Only four were larger than 4.0 cm; these were females. Of 21 individuals for which sex was determined, 15 were females and 6 were males. Females >6.5 cm long appeared to be reproductively mature and had eggs of two size classes, 0.4 to 0.8 mm and 3.0 to 4.0 mm diameter. No age determinations were made for this species.

The main prey of leatherfin lumpsuckers were hyperiid amphipods (*Parathemisto libellula*) which occurred in 23 of 25 stomachs

containing identifiable food. Gammarid amphipods occurred in six stomachs and mysids and polychaetes each in one.

Gymnelis viridis.—Twenty-seven fish doctors were caught at 12 stations throughout the survey area in 43–130 m. They ranged from 7.0 cm TL (1.2 g) to 11.4 cm TL (5.3 g). Three females longer than 9.0 cm were reproductively mature. The ovaries of each contained about 60 eggs 0.6 to 4.0 mm in diameter. No ages were determined for this species.

Thirteen stomachs contained identifiable food. Gammarid amphipods occurred in nine, caprellids in two, and mysids, polychaetes, and copepods each in one.

Icelus spatula.—Twenty specimens of the spatulate sculpin were caught at four stations ranging from 56 to 123 m. Eight were females with a mean length of 8.3 cm TL (range 5.5–11.0). Six were males with a mean length of 6.6 cm (range 5.6–7.5). Specimens ranged in weight from 1.6 to 14.1 g. No ages could be determined due to degraded otoliths. Eggs in the ovaries ranged from 0.2 to 1.2 mm and numbered 110–1,000. Eggs were more numerous and smaller than those of *I. bicornis*.

Of 10 stomachs containing identifiable food, 4 contained mysids, 3 gammarid amphipods, 2 shrimp, and 1 polychaetes.

Epifaunal Invertebrates

The following includes only data collected from the 33 trawls made in 1977. Invertebrates from the two 1976 trawls were not worked up in comparable detail.

We identified 238 species or species groups of invertebrates including 49 gastropods, 34 amphipods, 28 polychaetes, 27 echinoderms, 25 bivalves, 16 ectoprocts, and 14 shrimps. Only 14 species occurred in more than 20 trawls. All except the scallop *Delectopecten groenlandicus* (which was caught only east of long. 154°W) were found throughout the study area. Forty-one species occurred in 10 or more trawls and almost half of the 238 species occurred in fewer than 5 trawls. At 26 of 33 stations, echinoderms, mainly brittle stars and crinoids, were the most abundant invertebrate group. In most cases they composed more than 75% of the total trawl biomass.

At least two major community types seemed to exist. West of long. 154°W, brittle stars (usually *Ophiura sarsi*) were predominant. Associated species included soft corals (*Eunephthya* spp.) and sea cucumbers (*Psolus* sp. and *Cucumaria* sp.). At all stations where this brittle star community was found the bottom was muddy.

East of long. 150°W the invertebrate community was characterized by the scallop *Delectopecten groenlandicus* and the crinoid *Heliometra glacialis*. Sea cucumbers (*Psolus* sp.), sea urchins (*Strongylocentrotus droebachiensis*), several species of brittle stars (not *Ophiura sarsi*), and the shrimp *Sabinea septemcarinata* were usually among the most abundant species. Most trawls in which this species assemblage occurred were in rocky (cobble) areas.

Some trawls fell into neither of the above community types. Those trawls were generally in rocky areas between long. 158° and 162°W and between long. 150° and 154°W.

Brachyuran crabs.—The spider crabs *Chionoecetes opilio* and *Hyas coarctatus* are probably the two single most important forage species of bearded seals in Alaskan waters and are the most common food items of bearded seals in the Beaufort Sea (Lowry et al. 1979). *Chionoecetes opilio* is found from the Aleutian Peninsula north to the Beaufort Sea, across the Canadian Arctic and into the North Atlantic as far south as Maine. *Hyas coarctatus alutaceus* occurs from the Shumagin Islands south of the Alaska Peninsula north to the Beaufort Sea, throughout the Canadian Arctic, and off Newfoundland, Labrador, and Greenland (Garth 1958).

Forty-nine *C. opilio* were caught in eight trawls, all west of long. 155°W. Maximum carapace length was 7.5 cm. The largest male was 7.5 cm CL and the largest female was 6.8 cm CL. That female was the only ovigerous individual. The next largest female was 3.8 cm. MacGinitie (1955) reported catching no ovigerous females off Point Barrow. According to Watson (1970), 50% of males are mature at 5.7 cm and 50% of females at 5.0 cm. If maturation sizes are similar in the Chukchi and Beaufort Seas, the number of reproductively mature specimens in those areas is low. The ratio of males to females was about 2:1.

One hundred and ninety-two *H. coarctatus* were caught in 28 trawls. Maximum CL was 7.3 cm with an average length of 4.9 cm. The largest female was 4.6 cm, the largest male was 7.3 cm. MacGinitie (1955) reported similar maximum lengths of 4.9 cm for females and 7.5 cm for males. Approximately equal numbers of males and females were caught. Twenty-eight percent of all females were ovigerous with the smallest ovigerous female having a carapace length of 3.2 cm. Percent of ovigerous females varied from 50% west of Point Barrow to 18% east of there.

Shrimps.—Shrimps are major prey of bearded seals in the western Beaufort and northeastern Chukchi Seas and are sometimes eaten by ringed seals in those areas (Lowry et al. 1979). Fourteen species belonging to the families Hippolytidae (8 species), Crangonidae (5 species), and Pandalidae (1 species) were identified. All 14 species were also reported by MacGinitie (1955) from the Point Barrow region and by Carey (1977). MacGinitie and Carey together listed an additional five species from the Beaufort Sea which were not found in this study. Shrimp were present in all trawls with 2–8 species per trawl. In 22 tows, shrimp biomass was greater than fish biomass. This was especially true east of Point Barrow. A summary of distribution, abundance, and biological data for each species is given in Table 6.

Family Hippolytidae.—*Eualus gaimardii belcheri* was the most numerous shrimp in our trawls and occurred at 40–150 m on both muddy and rocky bottoms. It was the most numerous species by number and biomass at 10 stations, all of which were west of Prudhoe Bay. Although they were present throughout the study area, numbers decreased noticeably east of Prudhoe Bay. Minimum length was 5 mm CL and maximum was 14 mm CL. Maximum size of our specimens is considerably smaller than that (22 mm) reported by Squires (1970) for the eastern Canadian Arctic. Twenty-nine percent of the total number was ovigerous. The smallest ovigerous female measured 8 mm.

Eualus macilenta occurred at 28 stations in water depths of 40–400 m. It was the most numerous shrimp at three stations deeper than 100 m. *Eualus macilenta* and *E. g. belcheri* frequently cooccurred in trawls, with *E. g. belcheri* the most numerous in water shallower than 100 m and *E. macilenta* usually the most numerous deeper than 100 m. *Eualus macilenta* was present in all of the deeper trawls whereas *E. gaimardii* was often absent. Squires (1970) reported that it was most abundant in deeper, colder waters. Carapace lengths ranged from 6 to 12 mm with a mode at 9 mm. There were no ovigerous females; however, many females carried large, visible eggs under the carapace.

Eualus macilenta ranges in the west Atlantic from Greenland to Nova Scotia and in the North Pacific from the Okhotsk and Bering Seas to the Arctic Ocean at depths of 55–540 m (Squires 1970).

Table 6.—Summary of data collected on shrimps caught in the northeastern Chukchi and western Beaufort Seas during August–September 1977.

Species	Depth (m)	No.	Size		% ovig.	Smallest ovig.	No. of occurrences	Comments
			Range (mm)	Mode(s)				
Eualus gaimardii	40–150	1,302	5–14	9	29.4	8	23	Less numerous east of Prudhoe Bay
Sabinea septemcarinata	40–400	912	6–19	10,16	7.1	16	28	Most numerous east of Point Barrow
Eualus macilenta	40–400	542	6–12	9	0		28	Most numerous in water >100 m
Spirontocaris spina	45–400	80	5–16	9	35.7	7	14	
Sclerocrangon boreas	44–102	67	13–25	15,20	0		4	Only west of Point Barrow
Pandalus goniurus	40–400	59	7–25	9,13,19	6.8	16	12	Mainly west of Prudhoe Bay
Lebbeus polaris	50–150	37	4–16	6,10	2.7	12	12	Mainly east of Point Barrow
L. groenlandicus	50–80	6	13–22		16.6	22	3	
Argis lar	40–50	5	12–20		0		4	Only west of Point Barrow
Eualus fabricii	50–60	4	7–10		0		2	
Crangon communis	40–50	3	10–13		0		3	West of Prudhoe Bay
Spirontocaris phippsi	50	1					1	
Eualus suckleyi	50–110						4	Only presence or absence information available
Argis dentata	48–110	2			0		2	Only presence or absence information available

Eualus fabricii was caught in only two trawls at depths of 50 and 60 m. Size range was 7-10 mm CL. None was ovigerous. Elsewhere they are reported from the Japan Sea and the east Siberian coast to Alaska, the Arctic Ocean off Alaska, and the northwest Atlantic, at 4–200 m (Squires 1970).

Eualus suckleyi was identified from four trawls at depths of 50–110 m. No further information was noted for these specimens.

Lebbeus polaris was present in 12 trawls at depths of 50–150 m. Size range was 4–16 mm CL with modal sizes at 6 and 10 mm. Three percent of all individuals were ovigerous with the smallest ovigerous female measuring 12 mm. Squires (1970) in the Canadian Arctic reported the smallest ovigerous female to be 10 mm. In this trawl series *L. polaris* was found mainly east of Barrow. MacGinitie (1955) caught three specimens off Barrow. Squires (1970) summarized distributional information for *L. polaris* as follows: in the North Atlantic from the polar regions to Skaggerak and the Hebrides in Europe, to Cape Cod in America, in the North Pacific from the Aleutians, and Bering and Okhotsk Seas, at 0–930 m.

Six specimens of *Lebbeus groenlandicus* were caught at three stations in depths of 50–80 m. Carapace length ranged from 13 to 22 mm. A single individual (22 mm CL) was ovigerous. *Lebbeus groenlandicus* is present in the North Atlantic from east and west Greenland and from the Canadian Arctic to Cape Cod, in the North Pacific from arctic Alaska, the Bering Sea to Puget Sound, and the Sea of Okhotsk at depths <200 m (Squires 1970).

Spirontocaris spina was caught in 21 trawls at depths of 45–400 m. It was the fourth most numerous species of shrimp. Carapace lengths ranged from 5 to 16 mm with the main size mode at 9 mm. Thirty-six percent of all individuals were ovigerous and the smallest ovigerous female measured 7 mm CL. This species seemed to prefer rocky bottoms although it occurred at least once on a hard mud bottom. *Spirontocaris spina* is circumpolar. It is widespread in the North Atlantic, in the North Pacific from arctic Alaska, Bering Strait, Bering Sea, the Siberian east coast to the Alaska Peninsula and Vancouver, B.C. (Rathbun 1904; Squires 1970).

A single specimen of *Spirontocaris phippsi* was caught in 1977 in 50 m of water in the eastern part of the study area. Twenty-four individuals were caught in a single trawl off Pitt Point in 1976 at 40 m. Distribution is circumpolar. It occurs from arctic Alaska to the Shumagins, the Atlantic coast of America southward to Cape Cod, off northern Europe, in 10–250 m (Rathbun 1904).

Family Pandalidae.—We caught a single species of pandalid shrimp, *Pandalus goniurus*. *Pandalus borealis* was also reported near Point Barrow by MacGinitie (1955). *Pandalus goniurus* occurred in 12 trawls at depths of 40–400 m. Only 3% of the individuals were caught east of Prudhoe Bay. Individuals ranged from 7 to 25 mm CL. Although total sample size was relatively small (59) there appeared to be three size modes at 9, 13, and 19 mm. Seven percent of all individuals were ovigerous, the smallest ovigerous female measuring 16 mm CL. According to Rathbun (1904) *P. goniurus* ranges from the arctic coast of Alaska southward to the Okhotsk Sea and Puget Sound, in 5–250 m. Occurrence in water > 100 m is unusual.

Family Crangonidae.—Five species of crangonid shrimps were identified. Of these five, only one, *Sabinea septemcarinata,* was widespread and abundant.

Sabinea septemcarinata, the second most numerous shrimp in our samples, was collected in 28 trawls at depths of 40–400 m. It was the most numerous shrimp species in 15 trawls, all of which were east of Barrow. *Sabinea* occurred west of Point Barrow, but only in very low numbers (< 3% of the total shrimp catches). Carapace lengths ranged from 6 to 19 mm, with modes at 10 and 16 mm. Only 7% of all individuals were ovigerous and the smallest ovigerous female was 16 mm, considerably larger than the smallest ovigerous female (10 mm) reported by Squires (1970) for the eastern Canadian Arctic. *Sabinea septemcarinata* is widely distributed throughout the North Atlantic. It occurs in the Beaufort Sea and the east Siberian Sea at 45–345 m (Squires 1970).

Sclerocrangon boreas was present in only four trawls, all west of Point Barrow, in 44–102 m. Only two rocky bottom stations occurred west of Barrow and *S. boreas* was the dominant shrimp at both of those stations. Carapace lengths ranged from 13 to 25 mm with modes at 15 and 20 mm. No ovigerous females were present. Leech egg cases, reported by MacGinitie (1955) to be *Crangonobdella murmanica*, were present on the pleopods of several individuals. *Sclerocrangon boreas* is primarily an arctic species. It is present throughout the North Atlantic, in the North Pacific from

Bering Strait and Kilesnov to the Straits of Georgia, B.C., in the Arctic Ocean from Siberia to Point Barrow, at 0–400 m (Squires 1970). Squires (1969) reported this species from one shallow water station in the western Canadian Arctic (Franklin Bay).

Argis lar was present in four trawls west of Barrow, in 40–50 m. Carapace lengths were 12-20 mm. No ovigerous females were present. Carey (1977) reported *A. lar* from north of Camden Bay. It occurs from the arctic coast of Alaska and Siberia southward to Sitka and the Kuril Islands, and off Greenland, in 0–90 m (Rathbun 1904). Only two specimens of *Argis dentata* were identified. No further information is available on those specimens.

Crangon communis was identified from three trawls, all west of Prudhoe Bay, in 40–50 m. Range of carapace lengths was 10-13 mm. No ovigerous individuals were present. A single specimen of *C. communis* was taken by MacGinitie in 1949 (MacGinitie 1955). That was the first report of this species north of Bering Strait. Rathbun (1904) reported *C. communis* from the Bering Sea to San Diego, Calif., at 40–600 m.

Amphipods.—Gammarid amphipods are prey of many demersal fishes, seabirds, Arctic cod, ringed and bearded seals, and bowhead whales, *Balaena mysticetus* (Lowry et al. 1979). They occurred in 34 trawls, but seldom made up more than 2% of the total trawl biomass. Fifteen families and 34 species were identified. The families Lysianassidae and Ampeliscidae were represented by the greatest number of species, eight and five, respectively. Most species occurred at 1–3 stations. Seven including *Ampelisca eschrichti*, *Acanthostepheia behringiensis*, *Rhacotropis aculeata*, *Anonyx nugax*, *Socarnes bidentata*, *Stegocephala inflatus*, and *Stegocephalopsis ampulla* occurred at more than 10. Only *Rhacotropis aculeata* showed any obvious geographic variation in abundance; it was by far more numerous between Point Barrow and Prudhoe Bay than elsewhere.

Gastropods.—Snails are a regular prey item of bearded seals and walruses (*Odobenus rosmarus*) (Fay et al. 1977; Lowry et al. 1979). Thirteen families and 49 species were identified from our trawls. The families Buccinidae and Neptunidae were represented by the greatest number of species.

Margarites costalis occurred at all but six stations. It was the most numerous snail in the trawl survey.

Seven species of *Buccinum* occurred in the trawls. *Buccinum polare* and *B. scaliforme* were most numerous. Buccinid snails were in general more abundant west of Prudhoe Bay.

Ten species of the family Neptunidae occurred in the trawls. Snails of the genus *Colus* were most common, especially east of Prudhoe Bay. The genera *Plicifusus* and *Neptunea* were present mainly west of Prudhoe Bay.

East-west distributional patterns were indicated for several other species and genera. *Natica clausa* was found only west of Prudhoe Bay, and 9 of 10 tows in which *Polinices pallida* occurred were west of Prudhoe Bay. *Admete couthouyi* and two species of the genus *Trichotropsis* were present only west of Point Barrow.

Three species of the genus *Trophonopsis* (*Boreotrophon*) were represented in the trawls. Although these species occurred both east and west of Point Barrow, most specimens were caught east of Prudhoe Bay.

Bivalves.—Bivalve molluscs are generally abundant and diverse in the benthos. Carey (1977) listed 85 species in his arctic species list. Bivalves are a major food of walruses and bearded seals (Lowry et al. 1979).

Twenty-five species belonging to 12 families were identified from our trawls. Only seven species occurred in more than five trawls. The small transparent scallop *Delectopecten groenlandicus* was by far the most abundant species, although it was found only east of long. 150°W. It was abundant where it was present.

A small, chalky, heavy-shelled species, *Bathyarca glacialis,* was the second most numerous bivalve. It was caught only east of Prudhoe Bay and was patchy in occurrence.

Nuculana pernula occurred only east of the Prudhoe Bay area. Its occurrence coincided closely with that of *B. glacialis* and *D. groenlandicus.*

Cyclocardia crassidens was present throughout the area sampled, as was *Nucula tenuis*. Two species of *Astarte* were common. *Astarte montegui* was present in greatest numbers west of Prudhoe Bay whereas *A. crenata* was most numerous east of Prudhoe Bay.

Polychaetes.—Polychaetes are a major component of Beaufort Sea infauna (Carey 1977). They were also a regular component of the epifauna. Most specimens we collected were fragmented and in very poor condition. Nonetheless, 15 families and 27 species were identified. The scaleworms, Family Polynoidae, were the most widespread and numerous, occurring in 24 trawls. Three species, *Antinoella sarsi*, *Eunoe nodosa*, and *Gattyana cirrosa*, were most common.

Only two other species occurred at more than five stations. Those were *Nereis zonata*, most numerous west of Prudhoe Bay, and *Brada granulata*, present in all areas.

Echinoderms.—Echinoderms were by far the most abundant invertebrates in the western Beaufort and northeastern Chukchi Seas. We found 27 species: 15 asteroids, 7 ophiuroids, 1 echinoid, 1 crinoid, and 3 holothuroids.

Ophiuroids were most abundant but least diverse west of long. 154°W. *Ophiura sarsi* was the only species identified. East of long. 154°W numbers of ophiuroids decreased but at least six species occurred. *Ophiacantha bidentata* was the most common.

The sea urchin, *Stronglyocentrotus droebachiensis*, was present at rocky stations and absent from all muddy stations. It occurred in 14 trawls in relatively low numbers (usually fewer than 10/trawl).

Heliametra glacialis, a crinoid, was the dominant organism at 8 of 15 stations east of Prudhoe Bay. It was abundant at most of the other eastern stations, but did not occur at all west of Point Barrow.

Sea cucumbers were extremely numerous and widespread. *Cucumaria* sp. was present at 17 stations and *Psolus* sp. at 16. The two species often cooccurred.

Sea stars were the most diverse of the echinoderms, though never so abundant as other groups. *Crossaster papposus* and *Leptasterias groenlandicus* were the most common, each occurring in more than 20 trawls. The average number of species per trawl increased from 1.4 in the west to 3.7 in the east. The maximum number of species per trawl west of Point Barrow was three whereas east of Prudhoe Bay it was seven. This difference may be related to the increased number of small bivalves in the eastern area.

Other groups.—Sponges, anemones, flatworms, nemerteans, bryozoans, and tunicates were present in many trawls. The taxonomy of many of these groups is poorly known for arctic waters and thus the species lists presented in this report are incomplete.

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Appendix A. Fishes and invertebrates collected in the northeastern Chukchi and western Beaufort Seas in August-September 1977. Letters and numbers indicate stations (Figure 1).

PHYLUM PORIFERA

Unidentified sponge - 1, 16, 23, 26, 27, 31, 33, 34

FAM. AXINELLIDAE

Phakettia cribosa - 22

FAM. POLYMASTIIDAE

Polymastia mammilaris - 16, 20, 21, 24, 29

FAM. CRANIELLIDAE

Craniella crania - 17, 20

PHYLUM CNIDARIA

Thuiaria sp. - 3, 4

Lucernosa sp. - 3

Eunephthya sp. - 4, 5, 6, 8, 9, 13, 34

**Eunephthya rubiformes* - 1, 3, 10, 28

**Eunephthya fruticosa* - 1, 3, 7, 10, 22, 27

Unidentified anemone - 1, 3-6, 10, 11, 12, 14, 16-25, 27-34

PHYLUM PLATYHELMINTHES

Turbellaria - 22, 24, 27

PHYLUM RHYNCHOCOELIA

Nemertean - 4, 11, 24, 25, 27, 32

Cerebratulus sp. - 24, 25, 32

PHYLUM ANNELIDA

CLASS POLYCHAETA

FAM. POLYNOIDAE

Antinoella sarsi - 2, 6, 8, 19, 25, 27, 29, 30, 31

Eunoe nodosa - 1, 4-7, 9, 10, 14, 16, 20, 22, 24, 25, 27, 28, 32
Gattyana cirrosa - 1, 2, 4-9, 12, 17, 27, 29, 31
Harmothoe imbricata - 2
FAM. SPINTHERIDAE
Spinther sp. - 10
FAM. PHYLLODOCIDAE
Anaitides mucosa - 27
Anaitides maculata - 7
Phyllodoce groenlandica - 6, 12
Genetyllis castanea - 20
FAM. SYLLIDAE
Typosyllis fasciata - 10
FAM. NERIDAE
Nereis pelagica - 3
Nereis zonata - 1, 14, 16, 17, 20, 22, 24, 27, 28
FAM. NEPHTYIDAE
**Nephtys* sp. - 10
Nephtys ciliata - 17
Aglaophomus malmgreni - 19, 20, 22, 27
FAM. ONUPHIDAE
Onuphis sp. - 29
FAM. LUMBRINERIDAE
Lumbrinereis sp. - 7, 19
**Lumbrinereis fragilis* - 29
FAM. SPIONIDAE
Laonice cirrata - 31
FAM. FLABELLIGERIDAE
**Brada granulata* - 1, 2, 4-9, 11, 12, 20, 22, 30, 31
**Brada inhabilis* - 9, 12
Flabelligera affinis - 1, 6, 9
FAM. SCALIBREGMIDAE
Scalibregma inflatum - 27, 29
FAM. STERNASPIDAE
Sternapsis scutata - 18, 29
FAM. PECTINARIIDAE
Cistenides granulata - 1

Cistenides hyperborea - 5, 6, 8
FAM. AMPHARETIDAE
Amphicteis sp. - 22
FAM. TEREBELLIDAE
Amphitrite cirrata - 12

PHYLUM MOLLUSCA
CLASS GASTROPODA
ORDER ARCHAEOGASTROPODA
FAM. LEPETIDAE - 28
Lepeta caeca - 20, 25
FAM. TROCHIDAE
Margarites costalis - 1, 2, 4-12, 14, 16-20, 22-32, 34
Solariella obscura - 4, 6
Solariella varicosa - 2, 16, 17
ORDER MESOGASTEROPODA
FAM. TURRITELLIDAE
Tachyrynchus erosus - 4, 18, 19
Tachyrynchus reticulatis - 12, 18, 20, 30, 33
FAM. TRICHOTROPIDIDAE
Trichotropis borealis - 4, 5, 7, 8
Trichotropis kroyeri - 8, 9, 27
FAM. LAMELLARIIDAE
Onchidiopsis glacialis - 10, 26
Piliscus commondum - 10
Velutina sp. - 1, 10
Velutina undata - 3, 6, 8, 10, 34
Marsenina glabra - 1
FAM. NATICIDAE
Natica clausa - 1, 2, 4-8, 10-13, 34
Polinices pallida - 2, 4, 6-8, 11, 16, 18, 22, 34
ORDER NEOGASTROPODA
FAM. MURICIDAE
Trophonopsis (Boreotrophon) clathratus - 10, 22, 31
Trophonopsis (Boreotrophon) muriciformis - 2, 5, 18
Trophonopsis (Boreotrophon) beringi - 8-10, 13, 16, 17, 19, 20, 22-32

FAM. BUCCINIDAE

Buccinum sp. - 1, 10, 11, 23, 24, 28, 34, B

Buccinum angulosum - 1, 12, 19, 22, 29

Buccinum scalariforme - 1, 2, 8, 9, 12, 16, 18, 19, 28, 29, 31

Buccinum glaciale - 10

Buccinum solenum - 8, 9, 22

Buccinum polare - 1, 2, 5-8, 12, 22, 24, 25

Buccinum ciliatum - 2, 10, 17

Buccinum plectrum - 10, 16

FAM. NEPTUNIDAE

Beringius beringi - 17, 27, A

Colus sp. - 4, 20, 23, 24, 27, 28, 31, 34, B

Colus spitzbergensis - 34

Colus roseus - 4, 5, 9, 12, 20, 22, 28

Colus trombinus - 2

Neptunea sp. - 5, 13

Neptunea sp. c.f. *borealis* - 2, 4

Neptunea heros - 10, 12, 18, 20, B

Plicifusus kroyeri - 9, 10, 14, 17, 18, 27, 28, A

Pyrulofusus deformis - 18, 22

Volutopsius fragilus - 12, 24

FAM. CANCELLARIIDAE

Admete sp. - 6

Admete couthouyi (or *middeandorffiana*) - 4, 5, 7, 10, 12, 34

Admete regina - 29

FAM. TURRIDAE

Mangelia sp. - 12

Oenopota sp. - 4, 6, 7, 17

Oenopota turricula - 34

Oenopota harpa - 4, 8, 17, 20

Oenopota tenuicostata - 8

ORDER CEPHALASPIDEA

FAM. SCAPHANDRIDAE

Cylichna alba - 2, 5, 6

ORDER NUDIBRANCHIA

Unidentified nudibranch - 6, 8, 10, 25, 26

Dendronotus sp. - 3, 13
Dendronotus dalli - 17
CLASS POLYPLACOPHORA
Ischnochiton albus - 3, 10
Amicula vestita - 3, 10
CLASS BIVALVIA
ORDER NUCULOIDA
FAM. NUCULIDAE
Nucula tenuis - 2, 4, 5, 11, 15, 17, 31
FAM. NUCULANIDAE
Nuculana pernula - 18, 19, 20, 22, 24, 25-31, 33
Nuculana minuta - 4, 15, 17
Yoldia sp. - 7, 28, 29
Yoldia hyperborea - 2, 6, 18, 26
Yoldia myalis - 15, 17, 31
ORDER ARCOIDA
FAM. ARCIDAE
Bathyarca glacialis - 19, 20, 22-29, 31, 33
ORDER MYTILOIDA
FAM. MYTILIDAE
Musculus corrugatus - 10
ORDER PTERIOIDA
FAM. PECTINIDAE
Chlamys sp. - 1, 11, 17
Delectopecten greenlandicus - 14, 16-33
ORDER VENEROIDA
FAM. CARDITIDAE
Cyclocardia sp. - 9, 10, B
Cyclocardia c.f. *rajabiminae* - 4, 6, 7
Cyclocardia crassidens - 1, 2, 10, 12, 17, 20, 22
FAM. ASTARTIDAE
Astarte sp. - 5, 8, 9, 10, B
Astarte borealis - 1, 2, 12, 22
Astarte montegui - 2, 4, 8, 11, 12, 17, 19, 22, 27, 31, 34
Astarte crenata - 10, 14, 16, 18, 19, 20, 23, 24, 25, 27, 28, 29, 32, 33

FAM. CARDIIDAE
Clinocardium ciliatum - 2, 4, 7, 8, 13
Serripes groenlandicus - 4, 13
FAM. TELLINIDAE
Macoma calcarea - 4, 12
Macoma moesta - 7, 11, 15, 22, 31
Macoma loveni - 2
FAM. VENERIDAE
Liocyma fluctuosa - 17
ORDER MYOIDA
FAM. HIATELLIDAE
Hiatella arctica - 8, 9
ORDER PHOLADOMYOIDA
FAM. LYONSIIDAE
Lyonsia sp. - 5, 6
FAM. CUSPIDARIIDAE
Cuspidaria glacialis - 25
CLASS CEPHALOPODA
FAM. SEPIOLIDAE
Rossia pacifica - 28
FAM. OCTOPODIDAE
Octopus sp. - 1, 12, 14, 21, 22, 24, 28, B

PHYLUM ARTHROPODA
CLASS PYCNOGONIDA
Nymphon longitarse - 1
Nymphon brevitarse - 3, 20, 21, 24, 30
CLASS CRUSTACEA
SUBCLASS CIRRIPEDIA
Balanus crenatus - 10
SUBCLASS MALACOSTRACA
ORDER CUMACEA
Diastylis bidentata - 10, 27
Diastylis goodsiri - 19, 20, 29
Diastylis spinulosa - 19
ORDER ISOPODA
Saduria sabini - 29

Synidotea bicuspida - 2, 9, 10, 11, 20, 21, 22, 27
Synidotea nodulosa - 11
ORDER AMPHIPODA
FAM. ACANTHONOTOZOMATIDAE
Acanthonotozoma inflatum - 2, 7, 8, 11, 34
Acanthonotozoma serratum - 10
FAM. AMPELISCIDAE
Ampelisca macrocephala - 30
Ampelisca birulai - 27
Ampelisca eschrichti - 1, 2, 8, 11, 13, 14, 18, 20, 27, 28, 29, A
Byblis gaimardi (eschrichti) - 2
Haploops sp. - 2, 11, 16, 27
FAM. ATYLIDAE
Atylus smitti - 20, 21, 24, 27, 29, 32, 33
FAM. CALLIOPIIDAE
Halirages nilssoni - 2, 17
FAM. COROPHIIDAE
Ericthonius tolli - 10
FAM. EUSIRIDAE
Eusirus sp. - 14
Eusirus cuspidatus - 2, 10, 20
Rhacotropis aculeata - 1-4, 6-9, 11, 13, 14, 16, 17, 22, 32, A, B
Rozinante fragilis - 2
FAM. GAMMARIDAE
Maera sp. - 10
Melita sp. - 10
FAM. ISAEIDAE
Photis vinogradovi - 2
FAM. ISCHYROCERIDAE
Ischyrocerus latipes - 2, 10
FAM. LYSIANASSIDAE
Unidentified Lysianassid - 10
Anonyx sp. - 2
Anonyx nugax - 1, 2, 4, 6-11, 14, 18-22, 24, 25-31, 34, A, B
Anonyx laticoxae - 2, 22, 26, 27
Hippomedon sp. - 20

Orchomene sp. - 17
Socarnes bidenticulatus - 1-4, 8, 9, 10, 14, 22, 27, 30, 31, 32
Tryphosella (*Tmetonyx*) sp. 20, 22, 27, 30
FAM. MELPHIDIPPIDAE
Melphidippa goesi - 2
FAM. OEDICEROTIDAE
Acanthostepheia behringiensis - 2, 4, 6-9, 13, 17-20, 22, 24, 25, 27-31, 33, 34, B
Paroediceros lynceus - 2, 11, 34
FAM. PARAMPHITHOIDAE
Paramphithoe polycantha - 6, 7, 8, 11, 34
Paramphithoe cuspidata - 29
FAM. PLEUSTIDAE
Pleustes panoplus - 2, 7, 8, 9
FAM. STEGOCEPHALIDAE
Stegocephalopsis ampulla - 1, 8, 10, 11, 16, 21, 23, 24, 25-28, 30-33
Stegocephala inflatus - 1, 2, 3, 6, 8-11, 16-34, A, B
ORDER DECAPODA
SUBORDER NATANTIA
FAM. HIPPOLYTIDAE
Spirontocaris sp. - 7, 26, 31, 32
Spirontocaris phippsi - 1, 3, 8, 16-18, 21, 22, 27, 30, 31, A
Spirontocaris spina - 1, 7-10, 12, 14, 21, 23-26, 31, 32, A, B
Lebbeus groenlandica - 16, 21, 31
Lebbeus polaris - 1, 16, 21, 22, 24, 27, 28, 30-34
Eualus fabricii - 3, 17
Eualus suckleyi - 10, 16, 31, 32
Eualus gaimardii - 1, 2, 3, 5, 6, 7, 9, 10, 11, 16, 17, 18, 20, 21, 22, 25, 26, 28, 30, 31, 34, A, B
Eualus macilenta - 1, 2, 4-13, 16-20, 22, 24-32, 34, A, B
FAM. PANDALIDAE
Pandalus goniurus - 2, 3, 5-8, 10, 11, 12, 14, 32, 33, B
FAM. CRANGONIDAE
Crangon communis - 4, 5, 17
Sclerocrangon boreas - 1, 3, 8, 10
Argis lar - 5, 6, 7, 9, A, B

Argis dentata - 6, 32
Sabinea septemcarinata - 1, 2, 5, 7, 8, 11-34, A, B
SUBORDER REPTANTIA
SECTION ANOMURA
Pagurus sp. - 26, 31
Pagurus trigonocheirus - 2, 10-14, 16, 17, 18, 21, 24, 28, 30, 31, 32, 34, A
Pagurus rathbuni - 1, 4, 6, 8, 9, 11, 12, 13, B
Labidochirus spendescens - 2, 11, 13, 16, 30, 34
SECTION BRACHYURA
Hyas coarctatus alutaceus - 1-4, 8-28, 30, 31, 34, A, B
Chionoecetes opilio - 1, 4-7, 9, 11, 34, B

PHYLUM SIPUNCULA
Golfingia margaritacea - 1, 3, 4, 10

PHYLUM ECTOPROCTA
Alcyonidium vermiculare - 1, 9
Unidentified Flustrellidae - 10
Flustrella gigantea - 9
Beronicea meandrina - 17
Eucratea loricata - 1, 16
Tegella spitzbergensis - 16
Dendrobeania levinseni - , 7, 9
Dendrobeania murrayana - 3, 10
Rhamphostomella gigantea - 1
Cystisella saccata - 16, 18
Cellopora sp. - 10, 17
**Myriozoum orientale* - 10
Flustra membranaceotruncata - 1
Flustra serrulata - 4, 9, 11
Carbasea (*Flustra*) *carbasea* - 14
Escharopsis sarsi - 1, 10

PHYLUM BRACHIOPODA
Hemithiris psittacea - 27

PHYLUM ECHINODERMATA

CLASS ASTEROIDA

FAM. PORCELLANASTERIDAE

Ctenodiscus crispatus - 11, 12, 13, 29, 34, B

FAM. BENTHOPECTINIDAE

Pontaster tenuispinus - 23, 24, 25

FAM. PORANIIDAE

Poraniomorpha tumida - 20, 24, 25, 27, 30, 33

FAM. ECHINASTERIDAE

Henricia sp. - 1, 17

Henricia sanguinolenta? - 14

FAM. PTERASTERIDAE

Pteraster militaris - 30

Pteraster obscurus - 9, 17, 20, 24, 25, 26

FAM. SOLASTERIDAE

Crossaster papposus - 1, 3, 8, 9, 10, 14, 17, 20-32, 34, A, B

Lophaster furcifer - 21, 23, 24, 28, 29

Solaster dawsoni - 1, 11, 20, 24, 34, A, B

FAM. ASTERIIDAE

Leptasterias sp. - 4, 5, 7, 9, 10, 13, 16, 22

Leptasterias groenlandica - 5, 12, 16-33, A, B

Leptasterias hylodes c.f. *L. arctica* - 18

Urasterias lincki - 15, 18, 19, 24, 28, 29, 31, 33

Icasterias panopla - 21

CLASS OPHIUROIDEA

FAM. GORGONOCEPHALIDAE

Gorgonocephalus caryi - 12, 19, 29, 33, 34

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